UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA •SANTA CRUZ

ENVIRONMENTAL ENGINEERING PROGRAM
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
631 DAVIS HALL #1710
BERKELEY, CALIFORNIA 94720-1710

PHONE: (510) 643-0256
FAX (510) 642-7483

July 1, 2005

Bill Johnson
Pesticide TMDL Coordinator
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Dear Mr. Johnson:

Attached please find my review of the document titled, "Technical Basis of Water Quality Attainment Strategy and TMDL for Diazinon and Pesticide-Related Toxicity in Bay Area Urban Creeks". If you have any comments or questions, please do not hesitate to contact me by e-mail (Sedlak@ce.berkeley.edu) or by telephone.

Sincerely,

David L. Sedlak
Professor

cc: David Jenkins

Review of:
Technical Basis of Water Quality Attainment Strategy and TMDL for Diazinon and Pesticide-Related Toxicity in Bay Area Urban Creeks

David Sedlak
Department of Civil and Environmental Engineering
University of California, Berkeley

The draft document describing an attainment strategy and a TMDL for diazinon and pesticide-related toxicity proposes a series of steps designed to address toxicity observed in Bay Area creeks during the 1990s. The strategy addresses trends expected after the use of diazinon is discontinued and anticipates future problems associated with replacements for diazinon. The document analyzes regulatory responsibilities for pesticides in urban waters and public policy decisions associated with pesticide regulations. The public policy aspects of the draft document are beyond the scope of the scientific review that I have been asked to conduct. Therefore, my comments pertain mainly to the scientific issues used to determine the policies included in the TMDL.

Overall, the scientific issues associated with diazinon and other pesticides used in the urban environment are articulated clearly and interpreted correctly. The SFRWQCB staff members who authored the report have established that diazinon was likely responsible for the toxicity to *Daphnia* observed in whole effluent toxicity tests in the 1990s. They also have documented a shift in pesticide use from diazinon to pyrethroids and other pesticides. The report indicates that much of current urban pesticide use is associated with structural pest control, particularly ants, and the implementation plan targets these applications as a means of controlling toxicity in urban creeks. These interpretations appear to be correct and the staff members have not over-interpreted the scientific data or made any flawed interpretations. However, I have some concerns about issues that could help clarify the document or improve the implementation plan.

1. Accumulation of pyrethroids in sediments: In the linkage analysis (p. 68), the authors state that pyrethroids degrade at rates that are roughly equal to those of diazinon (i.e., 2-6 weeks). However, recent data suggest that certain pyrethroids may be much more persistent in sediments. For example, Gan et al. (2005) (J. Environ. Qual. 34, 836-841) recently reported half lives of over 1 year for bifenthrin and permethrin in sediments. Given the hydrophobicity of these compounds and their persistence, I believe it is quite possible that the concentrations of pyrethroids will increase over time in sediments. Although the use of these pesticides might not cause sediment toxicity at present, it is possible that the accumulation of pyrethroids might lead to toxicity as the concentrations approach steady state. Given the recent changes in use patterns, it may be appropriate to give priority to studies designed to monitor concentrations of the persistent pyrethroids in sediments and determine their rates of degradation under conditions encountered in urban creeks. It would be particularly interesting to track trends over the next decade or to compare current concentrations in

sediments with concentrations measured in archived samples if urban sediment extracts are available from previous sampling programs.

2. Assumptions regarding pyrethroid-related toxicity: On the basis of the available monitoring results, the SFRWQCB staff members have concluded that diazinon problems will be alleviated by the discontinuation of the pesticide's use. Therefore, monitoring should be focused on verification of this fact and assessment of potential problems associated with the replacements. Although the document clearly shows that use of pyrethroids has increased, much less evidence is presented to justify concerns about toxicity in urban streams. The pyrethroids were chosen as replacements in part because they were supposed to have less of an effect on aquatic ecosystems. I am aware of the findings of recent studies by Weston et al. showing toxicity in Central Valley waters near agricultural sites and was pleased to see that those same researchers have begun to study urban streams. However, the evidence offered to support the assertion that these compounds are problematic in urban streams in the Bay Area (p. 26-27) is referenced to a presentation (Amweg et al. 2005b). The paragraph implies that toxicity observed in the Sacramento area indicates that there also is toxicity in Bay Area creeks due to pyrethroids. Given the importance of this issue for the proposed strategy, I believe that it would be appropriate to contact the researchers and obtain some additional data that can be included in the document to help support the assertions made in this section. Alternatively, the SFRWQCB might want to dedicate resources to assessment of the role of pyrethroids and other replacement compounds in toxicity.

3. Evaluation of impacts of pesticide control strategies: The report describes a number of actions that have been taken to address toxicity associated with pesticide use in urban creeks. Over $2.5 million in grants and numerous activities by regulatory agencies are listed. Much of this funding has been dedicated to educational initiatives similar to those that may be implemented in the near future to control pyrethroids. These results of these activities have clear implications for future actions taken to address toxicity associated with the newly adopted pesticides. The report nicely describes the activities, but does not indicate any measure of the success of the different approaches. These and other programs provide a unique opportunity to learn how best to allocate resources to control urban pesticides. I suggest that the authors of the report consider including mechanisms for measuring success of future actions taken to control pesticide releases. For example, it might be worthwhile to collect baseline creek data and conduct surveys of consumer behavior (as described earlier in the document) before and after educational programs are implemented in different communities. These results could be compared to results from nearby communities where different programs or no programs are being implemented to determine the cost-effectiveness of the different actions. In any case, I believe that any future efforts to change behaviors of pesticide applicators should be coupled with programs designed to quantify the cost-effectiveness of the actions.

Minor comments:

4. Page 11: The text refers to Table 2.3, which includes the concentrations of diazinon in urban creeks. In addition to stating the range of concentrations it would be useful to include the geometric mean or median concentration.

5. Figure 3.2 depicts trends for diazinon use from 1995-2203. The figure shows only about a 50% decrease in diazinon use in agricultural applications and indicates that agriculture is the main use of diazinon now. Is it possible that there are still going to be localized areas of Bay Area creeks where diazinon will continue to be problematic? If so, it might be appropriate to consider TMDL's for those specific areas using approaches similar to those used for diazinon and chlropyrifos in the Central Valley.

6. Page 26: The document makes a statement about equilibrium partitioning of pyrethroids on sediments. The reference given is again a presentation by Amweg et al. (2005b). I suggest that the authors also consider referencing partition coefficients reported by Gan et al. (2005).

7. Table 6.1 (p. 52) indicates that only 1% of the 200,000 pounds per year of malathion applied in the Bay area is applied by professionals. Does this mean that Bay Area homeowners are applying all of this malathion?

8. Page 70 discusses the tendency of pesticides to volatilize. For application of a pesticide to an inert surface it might be appropriate to consider vapor pressure as a predictor of the tendency to volatilize. However, the Henry's Law constant probably makes more sense as a predictor of volatilization from soil or water. For hydrophobic compounds, such as pyrethroids, Henry's Law constants can be relatively high, even if the vapor pressure is low. I think that he Henry's Law constant should be mentioned in this section.

9. Page 71: The discussion in the third paragraph implies that solubility determines the return of adsorbed compounds to the water column. It is the partition coefficient (or at least the octanol/water partition coefficient) that one normally uses to predict particle/water partitioning. Aqueous solubility is correlated with partitioning for many of these compounds, but is not technically correct.